(C)

REPORT

ON THE

Agricultural Station Orai, Jalaun

OF THE

UNITED PROVINCES OF AGRA AND OUDH,

FOR THE YEAR ENDING JUNE 30th, 1906.

ALLAHABAD:

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ERRATA *to the Report on the Agricultural station Orai, Jalaun, of the United Provinces of Agra and Oudh, for the year ending June 30th,* 1906.

Page.	*Line.*	*For*	*Read*
1.	54	... this	... that
2.	14	... defines	... define
2.	Under subsoil Pandua	... 554	... 5·54
2.	Under diameter	... ∠002"	... ∠002,,
3.	Under rice 11	... nitrate of lime	... nitrate of potash
4.	2	... outturn per acre	... outturn per acre in Lbs.
4.	2	... outturn per acre	... outturn per acre in Lbs.
4.	Under Kabar (1904-05)...	393	... 383
5.	2	... 1904-05	... outturn per acre in Lbs. 1904-05.
6.	1	... latter	... former
6.	10	... cernuns	... cernuus,
6.	18	... outturns	... others.
6.	Against character and size of head line 27.	compact to loose	... compact—to loose.
6.	Against character and size of head line 32.	compact to loose	... compact—to loose.
7.	Under group c in column six.	character and size of grain.	character and size of head.
7, 8 and 9.	Against Nos. 2, 3, 5, 6, 7, 8, 9, 13, 14, 23, 24, 26, 28, 31, 32, 33, 36, 37, 42, 43, 48, 49, 51, 52, and 55 *add*—after compact		
9.	Against Nos. 44, 45 and 47	take off—after compact	
10.	Under Kabar Banda district.	mithni	... mithui.
11.	48	... but hardly ever fed alone.	but the prickly pear is hardly ever fed alone.
12.	Against January 31	... leaves cut	... leaves were cut.
Appendix A, against September 13th...		21	... ·21

No. $\frac{18}{A—275}$ OF 1906.

FROM

W. H. MORELAND, ESQ., C.I.E., I.C.S.,
DIRECTOR OF LAND RECORDS AND AGRICULTURE,
UNITED PROVINCES,

TO

THE CHIEF SECRETARY TO GOVERNMENT,
UNITED PROVINCES.

Dated Cawnpore, the 2nd of October 1906.

SIR,

I HAVE the honour to submit the report on the Orai Agricultural Station for the year ending 30th June, 1906.

2. The report has been drawn up by Mr. J. M. Hayman, the Deputy Director, who has been in charge of the experiments at Orai throughout the year.

I have the honour to be,
SIR,
Your most obedient servant,
W. H. MORELAND,
Director.

CONTENTS.

	PAGE.
CHAPTER I.—*The principal objects of the station, history, situation and soils* ...	1—2
Analyses of soils	2
CHAPTER II.—*Trials of different varieties of crops*—	
Maize	3
Cotton	3
Wheat	3
Rice	3—5
CHAPTER III.—*Classification of Bundelkhand Juars*	5—10
CHAPTER IV.—*Miscellaneous*—	
Agave sisalana	10
Cryptostegia grandiflora	10
Trial of Agave lurida as famine fodder	11—14
Propagation of spineless cactus ditto	14
Trial of plants for drought resistance	14
Linseed rust	14
Kans killing	14
Trial of implements	14
Rabi outturns	15
Concluding note	15
APPENDIX A.—Character of the season and rainfall	16
Do. B.—Map	17

Report on the Agricultural Station Orai, Jalaun, for the year ending June 30th, 1906.

CHAPTER I.

HISTORY &c.

Objects of the Station.

The principal objects of the station are :—

I.—To raise a rust resistant wheat for Bundelkhand.

II.—To study the varieties of cotton and select, test and propagate the best strain or strains for distribution on the lines indicated in the Cawnpore report.

III.—To bring one closer in touch with the cultivator and the cultivation of the different classes of soils, to study the existing methods and to ascertain how far the soils and the nature of seasons admit of any improvement.

History.

For some five years work has to some extent been carried on in the vicinity of this station on a small rented area. In the first instance for the trial of drought and rust resisting wheats bred at the Cawnpore station for Bundelkhand, while later under the orders of Government a further area was devoted to attempts at the extermination of *kans* by *banding* and flooding and to the trial of growing rice with canal water; a large number of rices being collected from the Duab, Oudh and Bundelkhand for this purpose.

Situation, area and soils.

The experimental station is situated about one mile from the Orai railway station on the Great Indian Peninsula Railway and about an equal distance from the Orai Collectorate.

The land has been acquired by Government and the necessary buildings have been erected by the Department during the year under report. The whole area in possession is 81·01 acres, out of which 7·56 acres have been utilized for building purposes, &c. A distributary of the Betwa canal supplies water to all parts but is only available after the setting in of the rains and up to the month of December and is liable in years of deficient rainfall to be insufficient. The construction of additional reservoirs at the head of the canal is expected largely to remedy these defects.

This situation for experimental work was chosen as being easily approached by rail, near a railway station, and comprising blocks of land fairly representing the four principal soils of Bundelkhand, at the same time separated by no great distance from each other and the office buildings.

The four principal soils of Bundelkhand are *mar*, *kabar*, *pandua* and *rakar*.

Mar—Is a strong black calcareous loam specially noted for its large deep cracks in the hot weather, its power of absorbing water during the rains and friability when being worked. Lumps of *mar* fracture with a distinct grain, showing small granules of lime and readily breaking down with time and light showers of rain. This soil is chiefly devoted to wheat or wheat and gram. By custom it is never manured and requires no irrigation in ordinary years.

Mar block lies to the south-east about a mile from the buildings in the village of Kuinyan.

Kabar—Is a dark (usually) clay soil, lighter in colour than, and inferior in quality to, the best *mar*, and generally contains small black pellets which consist chiefly apparently of iron with smaller quantities of silica, manganese oxide, magnesia and lime. It may also contain small nodules of lime. Sticky and cohesive when wet, on drying it hardens and ploughs up with difficulty in large lumps which give a smooth fracture and do not readilybreak down.

Kabar block lies a few furlongs to the north-east of buildings in the village of Ikhlaspur.

It differs somewhat in colour and clayiness in different localities and sometimes receives such prefixes as *Loha-kabar*, *Hara-kabar* &c. in consequence.

At the experimental station it is contiguous to *Mar* and shades off gradually from this soil.

It is devoted chiefly to wheat and gram mixed in the rabi and juar, cotton &c. according to season in the kharif.

Parwa block lies to the east of the buildings about two miles off in the village of Minora Kalpi.

Pandua or Parwa—Compared with *kabar* is a light loam. It varies somewhat in colour with the locality from a light brown to a greyish colour and in quality with its position and manuring. Easy to work and responding readily to water and manuring it will grow most crops with these facilities. Without irrigation the principal rabi crop is gram and barley mixed.

Rakar block lies a few furlongs to the north-west of the buildings and is also in the village of Ikhlaspur.

Rakar (stony).—No doubt so called in consequence of the presence of *kankar* nodules. It is found on slopes and along ravines and represents a degraded soil, the result of denudation by running water and the deposit elsewhere of its best material. It varies somewhat with the kind of soil from which it is derived and the amount of erosion to which it has been subjected. Thus we have *mota-rakar* and *patla-rakar*—terms sometimes used loosely, sometimes represented by other names in different places, but which defines clearly enough differences in quality which exist. It grows poor crops of juar and bajra in the kharif, or gram and the poorer pulses in the rabi.

The following shows the complete analyses carried out by Dr. Leather, Imperial Agricultural Chemist, of *mar* and *pandua* soil.

Owing to an unfortunate accident those of *Kabar* and *Rakar* are unable to appear in the year under report.

Constituents.	Surface soil Mar land 6".	Subsoil Mar land 6".	Surface soil Pandua land 6".	Subsoil Pandua land 6".
Insoluble silicates and sand ...	74·74	73·96	86·38	84·28
Ferric Oxide	5·59	5·78	3·26	4·25
Alumina	9·23	8·57	5·42	5·54
Lime	2·38	2·49	·69	·75
Magnesia	1·40	2·05	·71	·66
Potash	·81	·74	·52	·45
Soda	·55	·15	·22	·68
Phosphoric acid	·09	·08	·03	·02
Sulphuric acid	·007	·008	.007	·007
Carbonic acid	·30	·35	·09	·02
Organic matter and combined water...	4·90	5·82	2·67	3·34
	100·00	100·00	100·00	100·00
Nitrogen	·04	·04	·04	·03
Available phosphoric acid ...	·010	·008	·014	·007
Available potash	·015	·016	·011	·008

The following shows the mechanical analyses of the same soils and sub-soils:—

	Diameter.	Mar.		Pandua.	
		Surface soil.	Sub-soil.	Surface soil.	Sub-soil.
Sand	>·25 m. m.	1·85	2·0	·3	·7
	·25 to ·032 „	31·90	28·45	46·30	43·9
	·032 to ·016 „	35·1	35·7	30·05	30·8
	·016 to ·008 „	7·1	9·75	6·40	7·25
	·008 to ·004 „	7·6	8·4	5·75	6·0
	·004 to ·002 „	11·0	11·1	8·00	7·9
	<·002"	1·35	1·05	·85	·85

These soils contain comparatively very little fine material.

CHAPTER II.

TRIALS OF DIFFERENT VARIETIES OF CROPS.

1. *Maize.*—Two varieties of maize were tried, *i.e.* Jaunpur and Cawnpore *desi* on *Pandua* soil, without manure. The plants were stunted and gave a poor outturn. On small patches, where manure and irrigation are available, it may perhaps be grown but otherwise the conditions are unfavourable to the growth of maize in parts of east Bundelkhand.

2. *Cotton.*—Of the many varieties of cotton received, seven were selected as most suitable for trial at Orai.

The trial of *Bani* was suggested by the Board of Agriculture, but as this had already been fully tried at Cawnpore and found wanting it was thought best not to carry on any experiments at Orai.

A careful examination shows that Jalun *kapas* and *kapasi* are identical. The same can be said of *Karwi* Nos. 1 and 2. Jalaun *kapasi* is reckoned locally as superior to Jalaun *kapas*, the same being the case with *Karwi* Nos. 1 and 2; the superiority depending wholly on locality, soil or chance. Gwalior *bagchini* gives some promise of being a heavy cropper both at Orai and at Cawnpore, but it must be remembered that the experiments are only tentative and that the results were obtained with irrigation.

All varieties obtained consisted more or less of yellow and white flowered plants except *Bani*, which was altogether yellow, and there was also a varying proportion of broad and narrow leaved trees. These were marked and the seed separately selected, and in addition several other plants with special characteristics. Perhaps I may add the selections etc. have not been left to a subordinate but have been altogether done by me.

The following statement shows the unginned outturn per acre: they were obtained with irrigation :—

Serial No.	Name of variety.	Outturn per acre in lbs.			Remarks.
		Pandua.	Kabar.	Mar.	
1	Jalaun kapas ...	301	287	278	
2	Do. kapasi ...	309	469	...	
3	Karwi No. 1 ...	231	...	...	
4	Do. No. 2 ...	333	...	...	
5	Etawahpar ...	374	...	...	
6	Gwalior bagchini.	474	...	...	
7	Bani	350	...	...	

3. *Wheat.*—Several cross-bred wheats bred at the Cawnpore station were tried on small plots or in a few lines according as the small amounts of seed were available. The outturns in some cases, considering the year, appeared good but the areas are too small to make them worth recording per acre.

Rice.—Most of the rices sown in the previous year were again duplicated on *Pandua* and *Kabar* soils. The season being an exceedingly dry one the results are due practically altogether to irrigation and the absence of the rice sapper which has in other years always done considerable injury. The broadcast rices were irrigated three to four times while the transplanted received five to six waterings. All plots received two weedings. Great difficulty was found in getting a convenient site for a nursery there being no well giving sufficient water near and canal water not being available at this time. Eventually plots were obtained in the Municipal gardens at Orai. The seed germinated sufficiently well but after about a week the plants in many plots became etiolated. Poudrette, bone superphosphate, lime water, nitrate of lime, ammonia sulphate and iron sulphate were tried separately in different plots but in each case practically with no effect; consequently it is difficult to understand what was the exact cause of the trouble. The following statements give the outturns in pounds per acre of transplanted and broadcast rices for the last year and the year under report.

Broadcast sown rices.

Serial No.	Variety and district.	Outturns per acre. 1904-05.		Outturns per acre. 1905-06.	
		Pandua.	Kabar.	Pandua.	Kabar.
	Sultanpur.	lbs.	lbs.	lbs.	lbs.
1	Satha	307	307	266	188
2	Sathi	369	307	379	276
3	Sonsar	395	373	492	366
4	Mutmari	496	270	502	256
5	Bagri	361	393	410	328
6	Lalbagri	459	373	410	328
7	Banki	443	242	286	410
8	Badshah-pasand ...	473	355	533	312
9	Mahin Kuari ...	373	369	262	266
10	Dehula	496	383	538	363
	Unao.				
11	Bakki	118	158	912	307
12	Kudehli	361	170	943	307
13	Ramui	270	141	758	369
14	Siyaur	295	147	584	184
	Cawnpore.				
15	Hansraj	67	45	286	*failed*
16	Ram Bhog	299	283	779	266
	Meerut.				
17	Siyah Dhan... ...	225	383	123	164
	Aligarh.				
18	Sathi Siyah... ...	328	541	169	256
	Banda.				
19	Lal Guthurwa ...	564	57	793	...
20	Patra	621	57	948	...
21	Lal Patarwa ...	775	57	1,503	281
22	Guthurwa Patariya ...	775	57	615	...
23	Mathli	902	225	1,127	315
24	Gulab Kali	215	113	...	225
25	Ajan	418	135	...	205
26	Arjanta	170	180	...	307
	Jhansi.				
27	Chingi	350	141	...	451
28	Paoni Bari	344	125	...	207
29	Ram Ker	170	141	...	215
	Jalaun.				
30	Bansmati	248	113	...	199
31	Padma	248	125	...	222
	Sultanpur.	*Transplanted rices.*			
1	Badshah pasand ...	218	113	1,183	...
2	Gogari	346	154	1,127	84
3	Siam-ghata	283	203	697	169
4	Dilkhusa	615	359	752	601
5	Bansmati white ...	590	201	1,039	106
6	Bansmati red ...	125	162	1,043	211
7	Mutmurda	274	225	1,056	...
8	Kank Zira	338	275	1,039	240
9	Joginia	283	203	1,277	...
	Unao.				
10	Ram Bhog	102	22	902	...
11	Sambhara	752	404	1,127	207
12	Jalsen	902	338	789	139
13	Hansraj	441	193	1,004	207
14	Jardhan	291	125	1,160	...

Transplanted rices—(concluded).

Serial No.	Variety and district.	1904-05.		Outturns per acre in lbs. 1905-06.	
		Pandua.	Kabar.	Pandua.	Kabar.
	Cawnpore.				
15	Bakki	125	84	1,578	...
16	Badalphui	621	170	789	...
17	Jardhan	186	166	1,390	...
18	Jabda	600	275	1,271	...
19	Katalwa	541	275	1,387	281
	Meerut.				
20	Ram Jawain ...	176	150	958	...
	Aligarh.				
21	Sondhi	662	344	958	135
	Saharanpur.				
22	Bankia	338	96	1,240	...
	Banda.				
23	Sankharcha... ...	225	37	594	128
24	Kala Sivadas ...	199	158	641	248
25	Banspore	283	225	873	600
26	Kahrey Mohar ...	141	98	1,014	188
27	Bansmati	451	283	1,082	270
28	Ram Jawain ...	254	127	1,127	161
29	Devdhan	225	55	1,082	188
30	Anokhy	182	197	1,191	492
	Jhansi.				
31	Lanji	262	180	1,127	185
32	Ramker	170	207	1,014	223

CHAPTER III.

CLASSIFICATION OF BUNDELKHAND JUAR.

Some 57 *juar* under local names have been received from Banda, Jalaun and Hamirpur districts. It is difficult to say at present if they have adapted themselves to any local conditions, in many cases they are exactly the same. The collection was made in order to obtain a survey of all varieties grown; to classify them botanically, and to ascertain what species really existed and what were mere varieties of the same. The collection can hardly be considered complete at present and will no doubt be added to gradually. It will I hope afford useful knowledge in any question of supplying seed and also add something to general agricultural information. I am indebted with the collection from Banda for much useful information from the present Collector.

From the tentative examination there appear to be only two or three species, the rest being forms and varieties of the same.

The *juars* for the sake of convenience have been—

(I)—grouped according to botanical characters,

(II)—arranged under the district from which they came.

In the latter case, in referring to the size of the grain as large and small, etc., the following standard has been taken :—

10 grains = 7 grams = extra large.
„ =5 to 6 „ = large.
„ =4 to 5 „ = medium.
„ =3 to 4 „ = small.
„ =2 to 3 „ = very small.

Mr. Burkhill, Reporter of Economic Products, has kindly allowed me to see his tentative classification of Indian *juars*. A part of my group C is evidently included in it under *Cernuns*, the only difference being that I note the general presence of awns. I have therefore used a portion of his description, somewhat changing the whole in order to include *Ankhmundi* which, as the name implies, the grain is somewhat hidden but which though slightly differing from the type, evidently belongs to this group and may be considered to be connected by *Dudhnagar* and *Bansmatia*. It is true that these three differ in general appearance from the others, but their glumes possess the main characteristics in a varying degree and equal difference in appearance might be claimed for many of the outturns.

Moreover, density or otherwise of head does not appear a reliable character unless actually very loose and spreading or very tight and compact, intermediate forms varying as far as I have observed.

Tentative Classification of the Bundelkhand Juars.

Group A. Glumes reaching 15 m. m. in length, uniform except at edges, thin there, exceeding the grain by 2·5 to 3 m. m. but allowing the latter when ripe to be seen, hairy on lower two-thirds, tips glabrous, pointed and often slightly incurved, veins distinct, grain single hard plump.

	Name of variety.	Locality.	Colour of grain.	Size of grain.	Character and size of head.	Colour of glumes.	Plant.	Remarks.
1	Andhari.	Jalaun.	Whitish yellow.	Large.	Compact to loose $3\frac{1}{2}'' \times 8''$	Yellow.	Tall.	

Group B. Glumes 11 to 12 m. m., long barely equalling grain or as slightly exceeding it, uniform except at edges, thin there, hairy on lower two-thirds, tips glabrous oval or slightly oblanceolate, veins distinct; grain exposed rather soft.

	Name of variety.	Locality.	Colour of grain.	Size of grain.	Character and size of head.	Colour of glumes.	Remarks.
1	Miscellaneous.	Unknown.	White.	Medium.	Compact to loose $2\frac{1}{2}$ to 4×6.	Purplish.	Poor specimen to judge from.

Group C.—Glumes not exceeding grain, generally much shorter and distinctly exposing it, hard below, thin and depressed in the upper part, broad below the point of demarcation and frequently transversely creased or wrinkled, edges more or less ultimately ragged, awns always present to a greater or less extent.

(*a*)—Glumes with conspicuous hair on them in the upper part.

I.—Grain single medium hard, softer when white :—

	Name of variety	Locality.	Colour of grain.	Size of grain.	Character and size of grain.	Colour of glumes.	Plant.	Remarks.
1	Ankhmundi	Banda ...	White ...	Medium...	Loose 3″—4″ ×9″—10″.	Yellow ...	Tall ...	Nos. 1, 1a and 2 all fine heads rather sweet smelling, similar in appearence and character of panicle and conspicuous number of unfertile spikelets, though the head is well grained; grain flat and rather soft. Glumes of all three broad and not small, of no. 1 equal to grain rather entire and more hairy on whole surface. Nos. 1a and 2—grain more exposed and hair confined more to upper portion. Nos. 3, 4, and 5 are alike in appearance, grain plump and greatly exceeding small glumes. Nos. 6, 7, 8 and 9 grain flat and very distinctly exposed. Nos. 11, 12, 13 and 14—points of glumes edged with purple. Nos. 13 and 14—less hairy in the upper part and more inclined to be entire. The remainder differing as they do in colour, size of grain and panicle present a good deal of difference in appearance, but have practically all small ultimately ragged wrinkled glumes.
1a	Dudhnagar	Banda ...	Do. ...	Large ...	Loose 3″—4″ ×9″—10″.	Do. ...	Rather tall	
2	Bansmati ...	Hamirpur	Do. ...	Do. ...	Compact 3½″ × 7″.	Do. ...	Short, thick.	
3	Dol ...	Banda ...	Do. ...	Medium...	Compact to loose 3″—4″ ×6″—8″.	Do. ...	Tall.	
4	Makka ...	Do. ..	Do. ...	Do. ...	Compact — spreading 3″—4″ ×7″—8″.	Reddish tinge.	Tall.	
5	Gogla ...	Do. ...	Do. ...	Small ...	Compact to loose 3″—4½″ ×7″—8″.	Purplish tinge.	Tall.	
6	Badmasia ...	Do. ...	Do. ...	Medium...	Compact to loose 3½″ × 7″—8″.	Yellow ...	Short.	
7	Charka ...	Do. ...	Do. ...	Small ...	Compact to loose 2½″ × 6″.	Reddish tinge.	Tall, thick.	
8	Daunra ...	Do. ...	Do. ...	Do. ...	Compact to loose 3″—3½″ ×6″—7″.	Reddish	Do.	
9	Mithai ..	Do. ...	Do. ...	Medium...	Loose 5″ × 7″.	Reddish purple tinge	Tall.	
10	No. I from Charka.	Do. ...	Yellowish white.	Large flat	Loose 4″ × 7″.	Red ...	...	Grain very flat.
11	From Dudhnagar.	Do. ...	Do. ...	Large ...	Loose ...	Reddish purple tinge	...	
12	Kashmir ...	Do. ...	Yellow ...	Medium...	Compact—4″ ×7″—8″.	Do. ...	Tall.	
13	Badri ...	Do. ...	Do. ...	Large ...	Compact to loose 3″—4″ ×7″.	Reddish...	Short, thick.	

	Name of variety.	Locality.	Colour of grain.	Size of grain.	Character and size of grain.	Colour of glumes.	Plant.	Remarks.
14	Khowa ...	Banda ...	Yellow ...	Medium...	Compact to loose 3″—4″ ×7″.	Reddish purplish tinge.	Tall ...	The colour of all grains is judged after threshing which causes some difference in appearance in those having a reddish colour for reasons mentioned below.
15	Bansmatia...	Do. ...	Do. ...	Small ...	Compact—3″ ×6″.	Reddish tinge.	Tall.	
16	Arara ...	Do. ...	Do. ...	Large ...	Compact—2″ —3″×6″.	Reddish purplish tinge.	Tall.	
17	Lalo or Jogan.	Hamirpur	Red, (base lighter coloured).	Large ...	Compact to compact—2½″ —3″×6″.	Purple tinge.	Tall, thick	Grain in head appears much darker looking than when threshed out on account of the light basal portion being covered by glumes.
18	Jogiya ...	Banda ...	Red (base light coloured).	Extra large.	Loose 3″×5″...	Do. ...	Tall ...	Grain also appears rather darker in head from the same cause.
19	Lal Eksara Jhalra.	Jalaun ...	All red ...	Very small.	Loose 2″×5″...	Do. ...	Short ...	Grain in head appears somewhat lighter in colour than 17 but darker after threshing as the glumes being very small the colour of the base is hardly affected.
20	Laliya Eksara Jhalra.	Do. ...	Pinkish red, base yellow.	Medium...	Compact to compact—2½″ ×4″.	Do. ...	Do.	
21	Lal Eksara	Jalaun ...	Red (base slightly yellow).	Do. ...	Compact to compact—3″ ×5″.	Do. ...	Do.	
22	Jogini ...	Banda ...	Pink ...	Large ...	Loose 2″—3″× 7″—8″.	Do. ...	Tall.	
23	No. II From Charka.	Do. ...	Pinkish white.	Medium...	Compact to loose 3″—4″ ×6″—7″.	Do. ...	...	
24	Dadri ...	Do. ...	Pinkish..	Small ...	Compact to loose 2″×7″.	Do. ...	Tall.	
25	Wani ...	Do. ...	Do.	Do. ...	Compact—3″× 6″.	Do. ...	Short, thick.	
26	Gudlari ...	Do. ...	Pinkish white.	Large ...	Compact to loose 3″×7″.	Do. ...	Tall.	
			(2) *Grain single distinctly hard and transparent looking.*					
27	Sufed Eksara.	Jalaun ...	Pearly white.	Small ...	Compact 3″×6″	Yellow ...	Short, thick.	
28	Miscellaneous.	Unknown	Pearly yellow.	Large ...	Compact ...	Do. ...	...	
			(3) *Grain double medium hard.*					
29	Sukh Lal ...	Banda ...	Yellow ...	Small ...	Loose 3″—4″× 9″.	Yellow ...	Tall.	
30	Kumbhara Pira Dohra Jhalra.	Jalaun ...	Do. ...	Do. ...	Loose 3″×9″	Do. ...	Tall, thick.	
31	Mandaraji,	Banda ...	Do. ...	Medium...	Compact to loose 3½″×7″.	Do. ...	Tall.	

	Name of variety.	Locality.	Colour of grain.	Size of grain.	Character and size of grain.	Colour of glumes.	Plant.	Remarks.
32	Bauna Dohra Jhalra.	Jalaun ...	Yellow ...	Small ...	Compact to loose $3\frac{1}{2}'' \times 7''$.	Yellow ...	Short.	
33	Bauni ...	Banda ...	Do. ...	Do. ...	Compact to loose $3\frac{1}{2}'' \times 6''$ —7".	Do. ...	Tall.	
34	Dugdi ...	Hamirpur	Do. ...	Do. ...	Loose $3'' \times 7''$,	Do. ...	Do.	
35	Karwi ...	Banda ...	Do. ...	Medium...	Loose $3'' \times 7''$—8".	Do. ...	Do.	
36	Dugdi ...	Do. ...	Do. ...	Do. ...	Compact to loose $3'' \times 4''$.	Do. ...	Do.	
37	Kanchapi ...	Do. ...	Do. ...	Small ...	Compact to loose $2\frac{1}{2}'' \times 4\frac{1}{2}''$.	Do. ...	Tall.	
38	Kumbhara Pira Dohra.	Jalaun ...	Do. ...	Do. ...	Compact—3" $\times 5''$.	Do. ..	Short.	
39	Ghasua or Kumbhara.	Hamirpur.	Do. ...	Do. ...	Compact to loose $3'' \times 5''$.	Do. ...	Do.	
40	Mahdaiya ...	Banda ...	Do. ...	Large ...	Compact—3" $\times 5''$.	Do. ...	Tall.	
41	Arara ...	Hamirpur.	Do. ...	Very small.	Compact under $2\frac{1}{2}'' \times 4''$.	Do. ...	Do.	
42	Dugdi Yellow.	Banda ...	Pinkish yellow.	Medium...	Compact to loose $3'' \times 6''$.	Do. ...	Do.	
43	Karsia ...	Do. ...	Do. ...	Do. ...	Compact to loose $3'' \times 5''$.	Do. ...	Do.	
44	Sufed Dohra.	Jalaun ...	Yellowish white.	Small ...	Compact—i" $\times 6''$.	Do. ...	Short.	
45	Desi ...	Banda ...	Do. ...	Medium...	Compact—3" $\times 4\frac{1}{2}''$.	Do. ...	Do.	
46	Baidra ...	Hamirpur.	Do. ...	Small ...	Compact—3" $\times 6''$.	Do. ...	Short, thin.	
47	Ujar ...	Banda ...	Yellowish white.	Very small.	Compact—3" $\times$ 5".	Do. ...	Tall.	
48	Dugdi white.	Banda ...	Do. ...	Small ...	Compact to compact $3'' \times$ 5".	Do. ...	Do.	
49	Alagurdi ...	Do. ...	Do. ...	Do. ...	Compact to loose $2\frac{1}{2}''$—3" $\times 4\frac{1}{2}''$—6"	Do. ...	Do.	
50	Bauni ...	Hamirpur.	White ...	Do. ...	Compact—$3\frac{1}{2}''$ $\times 6''$.	Do. ...	Do.	
51	Lal Dohra...	Jalaun ...	Red (base slightly yellowish.)	Small ...	Compact to loose $3'' \times 7''$.	Purple tinge.	Short ...	Grain appears somewhat livid coloured in head.
	(*b*)—Glumes with little hair, hard portion glabrous shining, of various shades of red to black small fully exposing grain. Grain single, medium, hard.							
52	Miscellaneous.	Unknown	Yellowish,	Small ...	Compact to loose $2'' \times 5''$.	Red to purplish shining.	...	Upper glumes slightly keeled.
53	Do. ...	Do. ...	Yellow ...	Do. ...	Compact—2" $\times 6''$.	Reddish purple shining.	...	Ditto.
54	Do. ...	Do. ...	White ...	Do. ...	Compact—3" $\times 5''$.	Black shining.	...	Ditto.
55	Do. ...	Do. ...	Yellow ...	Small ...	Compact to loose $2'' \times 5''$ —6".	Purplish black.	...	Ditto.

Note.—Miscellaneous=Odd heads picked out of plots and differing from the main crop, the name of which was not noted.

From Charka, „ Dudhnagar etc. } =Heads picked out of main and differing from the main crop, the name of which was noted.

Juars with outturns in lbs. per acre, arranged according to the district they come from and the soil or soils on which they have been grown.

Mar.		Kabar.			Pandua.			Rakar.	
Name of juar.	Outturn lbs.	Name of juar.		Out-turn lbs.	Name of juar.		Out-turn lbs.	Name of juar.	Out-turn lbs.
			Jalaun district.						
Andhari Group AI	1201	Kumbhara			Bauna	Group			
Safed Dohra „ C. 44	840	Pira Dohra	Group C. 30	1066	Dohra Jhalra	„ C. 32	1624	Lall Jhalra Eksara Kaladaghi	Failed.
„ Eksara „ C. 27	1,066	Jhalra.			Lal Dohra	„ C. 51	830	Lal eksara Jhalra. Group C. 19	One head.
Bauna Dohra Jhalra. „ C. 32	758	Kumbhara Pira Dohra	„ C. 38	276	Lal Eksara	„ C. 21	533		
Lall Dohra „ C. 51	328	...			...		...	LalyaEksara Jhalra. Group C. 20	174
					...		...		
			Hamirpur district.						
Lalo or jogan „ C. 17	410	Dugdi	Group C. 34	1010	Baidra	Group C. 46	892		
Bansmatti „ C. 2	558	Arara	„ C. 41	246					
		Bauni	„ C. 50	656					
		Ghasau or Kumbhara	„ C. 39	512					
			Banda district.						
Wani Group C. 25	246	Mithni	Group C. 9	604	Makka	Group C. 4	1137	Ghus	Failed.
Dadri „ C. 24	164	Alagurdi	„ C. 49	758	Bauni	„ C. 33	1337	Gudlari Group C. 26	184
Charka „ C. 7	184	Kanchapi	„ C. 37	533	Badri	„ C. 13	358	Ujar „ C. 47	One head.
No. I from Charka. „ C. 10	—†	Arora	„ C. 16	164	Dudhnagar	„ C. 1 (a)	671	Bhadaili ...	Failed.
No. II from Charka. „ C. 23	—†	Jogiya	„ C. 18	88	From Dudh Nagar.	„ C. 11	—†	Jalwin ...	Failed.
Desi C. 45	82	Mahadaiya	„ C. 40	332	Dol	„ C. 3	840		
Daunra „ C. 8	One head.	Dugdi white	„ C. 48	758	Mandraji	„ C. 31	753		
Badimasia „ C. 6	328	Dugdi	„ C. 36	758	Gogla	„ C. 5	717		
Bansmatia „ C. 15	2 heads	Dugdi yellow	„ C. 42	1014	Karwi	„ C. 35	1086		
Ankhmundi „ C. 1	576	...		...	Jogini	„ C. 22	686		
					Sukhlal	„ C. 29	963		
					Karsia	„ C. 43	420		
					Kashmir	„ C. 12	768		
					Khowa	„ C. 14	876		

† Two or three heads found different from the main crop.

CHAPTER IV.

MISCELLANEOUS.

1. *Agave Sisalana.*—Suckers have been obtained from Saharanpur and a trial is being made on *rankar* soil. No great expectations are looked forward to, for one feels doubtful if it will grow luxuriantly, without which, quantity, quality and length of fibre must be affected. But it seems desirable to make the trial at this station if only to settle the question of its possible growth, there being large areas of poor soil along the banks of Bundelkhand rivers or rather their ravines.

2. *Cryptostegia Grandiflora.*—This creeper grows to a considerable extent about the collectorate and village of Orai. It flourishes on the poorest soils and remains green under the most trying conditions. Consequently when at first the rubber produced from its sap was valued three years ago at 2s.6d. per lb it was hoped that there were possibilities of a new industry for these parts. Various methods of extraction have been tried. The best sap is obtained from the older parts of the tree, that from the branches being watery and useless, as is also the case with first year shoots after ratooning. If people were very industrious, perhaps something might be done by women and children collecting in their leisure

time when the sap flows best. But the people are not of this sort, and for anything like a plantation the value would not more than cover the cost of collection (see also similar conclusion arrived at in the Madras Dictionary of Economic Products.)

3. *Trial of agave lurida (blue agave) as a famine fodder.*—The question of fodder in times of famine becomes so acute that people are reduced to giving cattle almost anything from old roof thatch to prickly pear after scorching off the spines.* What is really wanted to meet such conditions is a perennial plant which will grow and increase in ordinary years on waste land without trouble and form a provision requiring only to be cut in a year of fodder famine. Unfortunately no such plant seems to be known except such rather unpalatable things as prickly pear. Some years ago, *agave cantula* was fed as a trial to cattle in Bombay, but the result showed without any doubt that it was hopeless. In spite of this the great need to find something induced me to make a trial with *agave lurida* (the large leaved variety) with somewhat better results.

There being no blue *agave* near the Orai experimental station, the experiment was carried out at Cawnpore, except in the case of the trial with cultivator's cattle when the leaves were shipped to Orai. It may be objected that the method entails a great deal of trouble, but compared with having to *chhil* grass from early morning to evening when there is hardly a blade to be seen and collecting leaves and such like, the objection, provided the plants are not far removed, becomes insignificant. Objection to the question of fuel necessary for boiling may also be raised. But as a matter of fact, all that is necessary for this purpose can be obtained from the tips and peeling of the leaves when dry and some dung. It is not supposed for a moment that it will meet the need for fodder alone, as, if pushed too far, it produces diarrhœa (indicated in the trial at Cawnpore, when 80 lbs. were fed and eaten without other food by one pair of cattle in a day). Yet as an adjunct to other fodder, and to enable this to last out in hard times, it may not prove altogether impossible, provided it can be grown sufficiently near not to add distance to the trouble of preparation. But waste places are not near, everybody and certain soils may not suit its growth. There appears to be some difference as to the attitude of cattle with regard to it, some appearing to eat it readily when merely boiled and mixed with other fodder, others requiring it to be flavoured in some way. The trials at Cawnpore were made with well fed animals. Two pairs of oxen were selected, one pair was fed from the 15th of January to the 31st of January; the other pair from February 1st to March the 20th, when after a break of twenty days owing to pressure of other work the experiment was continued from April 13th to 19th. One animal was weighed before and after feeding for a week. No change in weight was observed. It was, however, said that after feeding some time, when put to work, the cattle appeared to have become less active. In considering the experiment it must be remembered that it is carried out to meet a condition in which cattle eat almost anything to keep alive. But before undertaking to recommend it as a poor adjunct to other food it requires a prolonged test for in dealing with a plant of this nature there is always a danger of some injurious results arising from its long continued use.

* NOTE.—Fire is also necessary for scorching off the spines of prickly pear, a custom sometimes practised in this country and one which has also existed in Texas and Mexico on ranches during prolonged seasons of drought since before the civil war, but hardly ever fed alone.

Experiment for feeding cattle with Hathi-chinghar (agave lurida) at Cawnpore showing quantity fed to one pair of cattle at a time.

Month and date.		Experiment.	Flavouring substance.	Whether Hathi-chinghar was given *alone* or with some other stuff.	Hathi-chinghar given to cattle weight in lbs.	Eaten up weight in lbs.	Left weight in lbs.	Observation and remarks
		First pair of oxen.						
January.	15	After peeling the skin the leaves cut into slices were boiled and added.	Salt ...	With dana ...	20	20	...	
	16	Ditto ditto ...	„ ...	„ ...	20	20	...	
	17	Ditto ditto ...	„ ...	„ ...	20	15	5	
	18	Ditto ditto ...	„ ...	„ ...	20	6	14	
	19	Ditto ditto ...	„ ...	„ ...	20	5	15	
	20	Ditto ditto ...	„ ...	„ ...	20	5	15	
	21	Ditto ditto ...	Gur ...	Alone ...	30	30	...	
	22	Ditto ditto ...	Salt ...	„ ...	30	30	...	
	23	Ditto ditto ...	„ ...	„ ...	40	40	...	
	24	Ditto ditto ...	...	„ ...	30	30	...	
	25	Ditto ditto ...	...	„ ...	30	28	2	
	26	Ditto ditto ...	...	After dana ...	30	10	20	
	27	Ditto ditto ...	...	„ ...	30	8	22	
	28	Ditto ditto ...	...	Before dana	30	22	8	
	29	Ditto ditto ...	...	„ ...	30	20	10	
	30	Ditto ditto ...	Salt ...	...	30	30	...	
	31	After peeling the skin the leaves cut into slices, to these raw slices added.	Gur ...	Alone ...	40	15	25	
		Second pair taken up for feeding experiment.						
February.	1	The skin being stripped off the leaves cut into slices were boiled and added.	Gur ...	...	30	30	...	
	2	Ditto ditto ...	„ ...	...	80	80	...	The dung was loose showing the stuff is purgative when given in excess.
	3	The skin being stripped off the leaves cut into slices, given raw.	None ...	Alone ...	30	...	30	Not eaten.
	4	The leaves with the skin being cut into slices were boiled.	„ ...	...	30	...	30	Not eaten.
	5	The leaves with the skin being cut into slices were boiled twice and added.	Salt ...	...	30	20	10	No advantage in boiling more than once: carried out owing to misunderstanding.
	6	The leaves with the skin being cut into slices were boiled and added.	Gur ...	...	30	30	...	
	7–15	The leaves with the skin being cut into slices and after giving three boilings, added.	„ ...	...	30	30	...	

Month and date.		Experiment.	Flavouring substance.	Whether Hathi-chinghar was given alone or with some other stuff.	Hathi-chin-ghar given to cattle weight in lbs.	Eaten up weight in lbs.	Left weight in lbs.	Observation and remarks.
	16	The leaves with the skin cut into slices were given three boilings, and added.	Salt ...	...	40	10	30	No advantage in boiling more than once, etc.
	17	Ditto ditto ...	„ ...	...	30	6	24	
	18-28	The skin being stripped off the leaves cut into slices were given two boilings and then added.	Gur ...	...	30	30	...	
March	1	The skin being stripped off the leaves cut into slices were boiled with half a seer *imli* leaves and then added.	Salt ...	With Dana ...	30	30	...	
	2	The skin being stripped off the leaves were cut into slices and then boiled with *imli* leaves.	*Imli* leaves.	„ ...	30	30	...	Not so eagerly.
	3	Ditto ditto ...	„ ...	„ ...	30	30	...	
	4	The skin being stripped off the leaves cut into slices and these raw slices with *imli* leaves were given.	„ ...	„ ...	32	...	32	Not eaten.
	5	The leaves with the skin were cut into slices and were boiled with *imli* leaves and flavoured with.	Salt ...	„ ...	32	32	...	
	6	Ditto ditto ...	„ ...	„ ...	30	30	...	
	7	Ditto ditto ...	„ ...	„ ...	40	40	...	
	8	Ditto ditto ...	„ ...	„ ...	45	45	...	
	9	The leaves cut into slices given to cattle raw.	...	„ ...	30	...	30	Not eaten up.
	10	The leaves cut into slices were given 3 boilings and added.	Salt ...	„ ...	30	30	...	
	11-15	The leaves cut into slices were boiled with *imli* leaves and then flavoured with	„ ...	„ ...	30	30	...	
	15-20	Ditto ditto ...	„ ...	„ ...	30	30	...	
		Experiment discontinued for 20 days.						Owing to other works interfering.
April	13	The leaves cut into slices were boiled with *imli* leaves and added.	Salt ...	„ ...	44	44	...	
	14	Ditto ditto ...	„ ...	„ ...	31	31	...	
	15	Ditto ditto ...	„ ...	„ ...	40	40	...	
	16	Ditto ditto ..	„ ...	„ ...	45	45	...	
	17	Ditto ditto ...	„ ...	„ ...	47	47	...	
	18	Ditto ditto ..	„ ...	„ ...	40	40	...	
	19	Ditto ditto ...	„ ...	„ ...	30	30	...	

Note.—The results of these experiments have been shown in the Orai report as they were carried out chiefly to meet Bundelkhand conditions.

Experiments in feeding Hathi-chinghar (agave lurida) at Orai with cultivator's cattle.—As mentioned the leaves were shipped to Orai from Cawnpore, there being no plant of this species at Orai available.

The leaves were distributed to some cultivators and directions given to them as to peeling, boiling and flavouring with *imli* or salt. In case one, the cultivators said that their cattle ate the leaves readily when prepared as directed and mixed with other fodder, and no ill effect was observed on their health. In case two, a cultivator misunderstood the directions, and, after peeling and boiling, only added fodder, omitting *imli* or salt. He fed his cattle in this manner for six days and the animals ate the food readily : no bad results were observed. In case three a cultivator omitted to peel off the rind and simply mixed the boiled leaves with other fodder ; the cattle refused to eat it.

A small trial was also made at Aligarh, simply boiling and mixing with *bhusa* without any salt or *imli* leaves. Well fed cattle refused to eat it ; those suffering from scarcity of fodder did so at once.

The following is the proportion finally adopted :—

Agave raw after being peeled	...	...	50 lbs.	
Water	...	...	4 „	
Salt	...	...	½ „	} alternately.
Imli leaves	...	...	1 „	}

After boiling the weight is reduced to 40 lbs :—

4. *Propagation of spineless cactus* (Opuntia ficus indica).—In view of the fact that in times of prolonged drought prickly pear is sometimes fed to cattle after scorching off the thorns and moreover after reading so much about the marvellous spineless *cactus* " created " by Luther Burbank, I have commenced to propagate two Indian forms. There is no necessity to " create " recessive characters in this country.

5. *Trial of plants for drought resistance.—Atriplex semibaccata* was sown in February on *rakar* soil, water was given sparingly for germination and the plants put out two to four leaves when they suddenly withered. The seed was again sown in April, this time in pots, when the same thing occurred. I did not see the plants at this time and cannot therefore give any exact explanation, but as likely to afford any thing of the nature of drought-resisting plants in this country, I think there can be no doubt as to its utter failure.

6. *Linseed rust.*—Three varieties of foreign linseed, Dutch, Russian and Australian, received as showing rust resistance at Pusa, were sown. Unfortunately for the experiment no rust occurred on the country variety in the year under report. It is intended, if they should really preserve their supposed character with regard to rust, to ascertain if there is any chance of their outturn comparing favourably with the country variety. Selection for rust resistance with the country varieties and other work in this connection will proceed as an insight into the character of the plants is acquired.

7. *Kans killing.*—The object of the experiment is to determine the best method of killing *kans* by flooding and other operations. The methods have been modified on my taking over the experiment and on including with others at the Orai Agricultural Station.

8. *Trial of implements.*—A trial with the Watts' plough is being given, but there seems less likelihood of its finding a position in Bundelkhand than in other parts of the Province.

The Surat method of sowing cotton with drills is also under trial. Its use requires some training both with regard to the oxen and men. Here again there are conditions which will probably conflict with its use, little advantage occurring except in years of drought. The Surat hoe and a three-lined cultivator are also under trial, but the same remarks as to the drill apply to this also.

9. The following statement gives some idea of the outturns of rabi crops during the year under report :—

Crop.	Outturn per acre in lbs.							
	Mar.		Kabar.		Pandua.		Rakar.	
	Un-irrigated.	Irrigated.	Un-irrigated.	Irrigated.	Un-irrigated.	Irrigated.	Un-irrigated.	Irrigated.
Pisia (wheat and gram) ...	...	...	215	1,537		891	...	...
Kathia (wheat and gram) ...	499 *246	820	297	...	...	440	...	30
(F. S.)[2] wheat	533	...	...	...	225	...	...	...
Gram after rice	...	...	221	...	430	...	...	...

N.B.—Unirrigated fields were flushed before sowing except in one case marked thus*.

This agricultural station having only been practically started in the year under report much time has been devoted in the putting up of necessary buildings, boring for water and laying out the land.

DATED CAWNPORE :
The 13th of September 1906.

J. M. HAYMAN,
Deputy Director.

APPENDIX A.

Character of the season.—The monsoon opened on the 6th of July, but from then to the close of the season general or prolonged rain never once fell. From time to time there were brief showers, often very local, sometimes falling on a small area, while adjacent fields were passed over, the heaviest rainfall only amounting to one inch. Such showers as were received were followed by clear skies and hot sun which largely cancelled the good effect they might have done. In many places in Bundelkhand conditions were less favourable than those at Orai and severe famine in consequence followed. The extreme drought was manifested by the unusual resort of flushing when possible *mar* land with all its difficulties.

Rust and insect pest, &c.—Owing no doubt to the severe drought very little rust was seen, cases of poisoning occurred from eating *juar* and, in one case, linseed reported by the Collector of Banda. In the *kharif* cotton bolls were to a considerable extent attacked by *eurias fabia* and *insulana* and in the rabi much damage was done to gram by surface caterpillars chiefly on *kabar* soils eating off the plants at the base of the stem.

Rainfall from June 1st 1905 to May 31st, 1906.

Month and date.	Total per day.	Total per month.
4th July 1905 ...	·08	
6th „ „ ...	·59	
7th „ „ ...	·26	
8th „ „ ...	·27	
12th „ „ ...	·19	
14th „ „ ...	·04	
15th „ „ ...	·96	
16th „ „ ...	·28	
18th „ „ ...	·28	
19th „ „ ...	·08	
21st „ „ ...	·75	3·78
2nd August 1905 ...	·01	
4th „ „ ...	·21	
14th „ „ ...	·11	
15th „ „ ...	·16	
18th „ „ ...	02	
19th „ „ ...	·65	
20th „ „ ...	·61	
26th „ „ ...	1·01	
29th „ „ ...	·10	2·88
5th September 1905 ...	·32	
6th „ „ ...	·12	
10th „ „ ...	·03	
11th „ „ ...	·85	
13th „ „ ...	21	
14th „ „ ...	·02	
16th „ „ ...	·04	
29th „ „ ...	·60	2·19
1st October „ ...	·10	·10
29th December „ ...	·02	·02
14th February 1906 ...	·02	
15th „ „ ...	·02	
16th „ „ ...	·07	
17th „ „ ...	·08	
22nd „ „ ...	·15	·34
22nd March „ ...	·26	
25th „ „ ...	·05	·31
		9·62

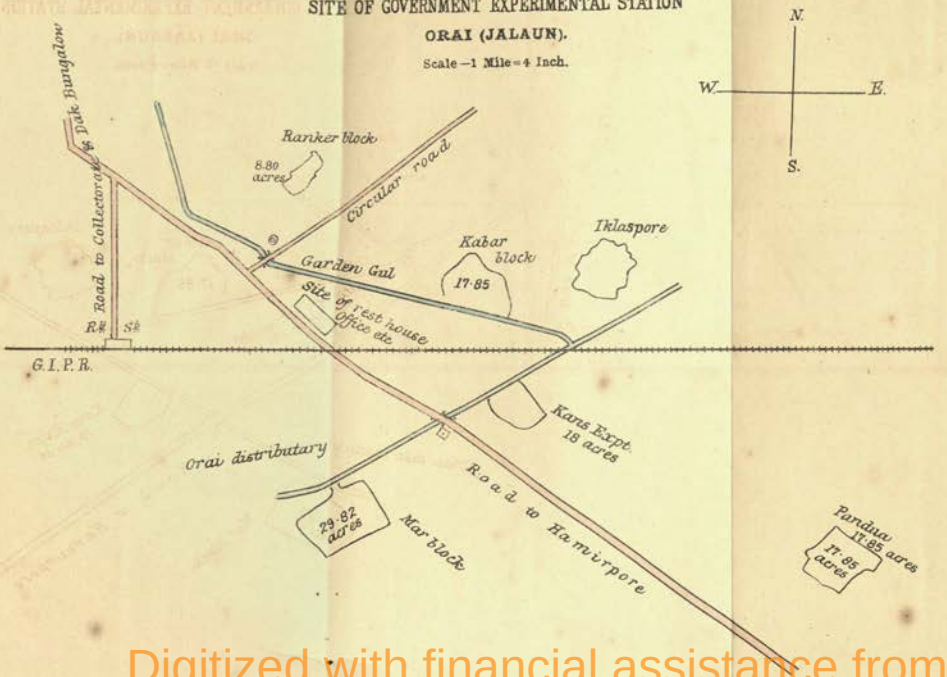
APPENDIX B.

MAP

SITE OF GOVERNMENT EXPERIMENTAL STATION

ORAI (JALAUN).

Scale—1 Mile=4 Inch.



NOTE.—Outline of blocks and width of roads not to scale distances and directions are partically correct.

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